

Appl. No. : 10/766,973
Filed : January 29, 2004

REMARKS

Reconsideration and allowance of this application is respectfully requested. Claims 1-28 are pending in this application. Claims 1-28 are rejected. Claim 1 has been amended.

In view of the argument below, Applicant submits that this application is in condition for allowance and such action is earnestly requested. The Office Action's reasons for rejection are addressed below.

§102 rejection

Claims 1, 6 and 7 stand rejected under 35 U.S.C. §102(b) as being "clearly anticipated" by U.S. Patent No. 5,412,684 to Schlie et al. ("Schlie"). Applicant respectfully disagrees with this rejection.

With reference to Fig. 1, Schlie teaches a microwave excited gas laser device comprising a tube 4 containing a mixture of inert gas and either metal vapor or an electronegative species, as known in the laser arts. To excite the laser, Schlie uses microwave energy provided by microwave sources 10 and 12, waveguides 14 and 16, and a helical coil 6. Schlie's main objective is to improve the temperature uniformity of the gas inside the tube 4, which in turn improves the laser quality. To solve this problem, Schlie provides a mandrel 8 that surrounds the tube 4, a heated reservoir 22 of a microwave transparent fluid, and tubing 23 that connects the mandrel to the reservoir. By circulating the microwave transparent fluid from the reservoir 22 through the mandrel 8 around the tube 4, Schlie attempts to create a substantially uniform temperature inside the tube 4. The helical coil 6 is wound around the mandrel 8, but the microwave energy passes through the microwave transparent fluid of the mandrel 8 to the gas inside the tube 4. In Schlie, microwave energy is first transferred to the inert gas inside the tube 4, which then transfers energy to the metal vapor or electronegative species to effect electronic excitations and subsequent lasing.

Applicant respectfully disagrees with the Office Action over the §102 rejection of Claim 1 because Schlie does not teach or include "a plasma chamber configured to be mounted in fluid communication between a source of gases and a processing chamber," as recited in Claim 1. The Office Action interprets Schlie's mandrel 8 as the claimed "plasma chamber." However, the mandrel 8 is not configured to be coupled to a processing chamber. Schlie does not teach or

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suggest any type of processing chamber. Nevertheless, in order to further distinguish the claimed invention from Schlie, Claim 1 has been amended above to clarify that the processing chamber is a semiconductor substrate processing chamber.

Insofar as the Examiner may interpret Schlie's tube 4 as the claimed "plasma chamber," note that the tube 4 is sealed at both ends and therefore is not configured to be mounted in fluid communication between a source of gases and a processing chamber. Each end of the tube 4 includes a Brewster window 47 that separates the gas mixture inside the tube 4 from an evacuated "arm" 46. Schlie desires the Brewster windows 47 to minimize reflective losses to the laser radiation, and the evacuated arms 46 to eliminate gas turbulence in order to achieve stable laser operation and good beam quality. Col. 5, lines 24-31. In addition, Schlie teaches placing mirrors 32 and 34 at the ends of the tube, to establish optical feedback and laser oscillation. Col. 5, lines 31-33. Schlie does not teach mounting the tube 4 to either a source of gases or to a processing chamber. Even if the tube 4 of Schlie were mounted between a source of gases and a process chamber, the tube 4 would not be in fluid communication with the source of gases and the processing chamber, due to the Brewster windows 47 and mirrors 32, 34. Accordingly, Applicant respectfully requests that the §102 rejection of Claim 1 be withdrawn.

Claims 6 and 7 depend from and therefore include all of the limitations of Claim 1, in addition to reciting features of particular advantage and utility. Schlie does not teach or include all of the limitations of Claim 1, let alone the unique combinations of limitations of Claims 6 and 7. Accordingly, Applicant respectfully requests that the §102 rejection of Claims 6 and 7 also be withdrawn.

§103 rejection

Claims 2-5 and 8-11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Schlie in view of U.S. Patent No. 5,841,244 to Hamilton et al. ("Hamilton"). The Office Action alleges that Schlie teaches all of the limitations of Claims 2-5 and 8-11 with the exception of a hollow tube for helix cooling. The Office Action cites Hamilton to meet this deficiency, asserting that "[u]se of particular cooling means such as pumps and jacket, as per the dependent claims is considered a matter of routine design dependent on the undersigned structure of the chamber and other undisclosed parameters of the system."

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Without acquiescing to the Office Action's reasons for rejection, Applicant submits that Claims 2-5 and 8-11 are allowable because they depend from and therefore include all of the limitations of Claim 1. Schlie does not teach all of the limitations of Claim 1 (see above), let alone the unique combinations of limitations of Claims 2-5 and 8-11, and Hamilton does not meet Schlie's deficiencies. Accordingly, Applicant respectfully requests that the §103 rejection of Claims 2-5 and 8-11 be withdrawn.

Claims 12-16, 18-23 and 25-28 stand rejected under 35 U.S.C. §103(a) as being unpatentable over "Microwave Devices and Circuits" by S.Y. Liao ("Liao") in view of Schlie. Liao teaches a helix traveling wave tube designed to transfer energy from an electron beam to a signal wave on a helix to amplify the signal wave. *See* Liao, Fig. 6-4-2 and the related text. The Office Action asserts that Liao teaches all of the limitations of Claims 12-16, 18-23 and 25-28 with the exception of a microwave helix type energizing system for the plasma. However, the Office Action finds that Schlie meets this deficiency, and that it would have been obvious to modify Liao with Schlie "to enable more efficient generation of the plasma for the processing."

Applicant respectfully disagrees with the rejection of independent Claims 12 and 21. First, there is no motivation in the art to conduct the asserted combination. Liao's objective appears to be to amplify a microwave signal. Liao achieves this goal by conducting a slow wave signal through a helix and shooting an electron beam through the helix. The Office Action's purported motivation to combine Liao with Schlie, "to enable more efficient generation of the plasma for processing," is completely irrelevant to Liao. The Liao excerpt that has been cited does not involve plasma processing, and in fact does not even use the word "plasma." In operating the Liao apparatus, the skilled artisan simply would not be motivated to generate plasma, let alone to improve upon a non-existent plasma generation. Therefore, Schlie's teaching of using a helix to impart microwave energy to a gas fill of a laser beam would not have motivated the skilled artisan to modify Liao.

Second, even if there was a motivation to combine Liao and Schlie (Applicant is not suggesting that such a motivation exists), the combination of Liao and Schlie does not meet the language of independent Claims 12 and 21. Neither reference teaches or suggests a source of process gases in fluid communication with a plasma tube, a process chamber, directing plasma products into a process chamber, or impinging plasma products on a substrate to remove a mask

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layer on the substrate, as recited by the claims. Further, it is unclear as to exactly how these references could be combined at all, let alone in a manner that would result in the claimed invention. The modes of energy transfer in Liao and Schlie are fundamentally different. Liao involves transfer of energy from an *electron beam* to a slow wave on a helical coil, and Schlie involves transfer of energy from a helical coil to a gas mixture to form a *laser beam*. In Liao, the transfer of energy is to the slow wave on the helical coil. In Schlie, the transfer of energy is from the helical coil. It would seem that the only conceivable way to combine Liao and Schlie is to use two coils, wherein an electron beam is shot through the first coil to amplify a slow wave thereon, and a second coil receives the signal and is wound around a gas tube to excite a laser beam. Such an apparatus would not include all of the limitations of the present claims. Accordingly, Applicant respectfully requests that the §103 rejection of Claims 12 and 21 be withdrawn.

Claims 13-16, 18-20, 22, 23 and 25-28 depend from and therefore include all of the limitations of either of Claims 12 and 21, in addition to reciting features of particular advantage and utility. The combination of Liao and Schlie does not meet all of the limitations of Claims 12 or 21, let alone the unique combinations of limitations of Claims 13-16, 18-20, 22, 23 and 25-28. Accordingly, Applicant respectfully requests that the §103 rejection of Claims 13-16, 18-20, 22, 23 and 25-28 also be withdrawn.

Claims 17 and 24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Liao in view of Schlie, as applied to Claims 12-16, 18-23 and 25-28, and further in view of Hamilton. Without acquiescing in the Examiner's reasons for rejection, Applicant submits that Claims 17 and 24 are allowable because they depend from and therefore include all of the limitations of Claims 12 and 21, respectively. The combination of Liao and Schlie does not meet all of the limitations of Claims 12 and 21, let alone the unique combinations of limitations of Claims 17 and 24, and Hamilton does not meet the aforementioned deficiencies of the Liao/Schlie combination. Accordingly, Applicant respectfully requests that the §103 rejection of Claims 17 and 24 also be withdrawn.

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CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully submits that this application is in condition for allowance and requests the same. If there is any further hindrance to allowance of the pending claims, the Examiner is invited to contact the undersigned.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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AMEND

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